U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-259 690-T

Neurohistological Methods in Hygienic Standardization

Environmental Protection Agency, Research Triangle Park, N C

1972

321003

PB 259 690-T

EPA-TR-274-73

NEUROHISTOLOGICAL METHODS IN HYGIENIC STANDARDIZATION

(Neyrogistologicheskie metody pri gigienicheskom normirovanii)

N. G. Fel'dman

Gigiena i Sanitariya, April 1972, No. 4, pp. 86-88

Translated for EPA by
SCITRAN (SCIENTIFIC TRANSLATION SERVICE)
SANTA BARBARA, CALIFORNIA

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

BIBLIOGRAPHIC DATA SHEET	1. Report No. EPA TR73-274	2.	3. Recipient's Accession No.
4. Title and Subtitle Neurophysical methods in hygienic standardization			5. Report Date 1972
			6.
7. Author(s) N.G. Fel'dman			8. Performing Organization Rept. No.
9. Performing Organization Name and Address TRANSLATED FROM RUSSIAN BY EPA			10. Project/Task/Work Unit No.
			11. Contract/Grant No.
12. Sponsoring Organization Name and Address Translation Service Office of Administration - Library Research Triangle Park, NC 27711			13. Type of Report & Period Covered
			14.

15. Supplementary Notes

GIGIENA i SANITARIYA April 1972, No. 4, pp.86-88

16. Abstracts

17. Key Words and Document Analysis. 17a. Descriptors

~~TRACE ELEMENTS~~
~~MEDICAL RESEARCH~~
EPAISD

17b. Identifiers/Open-Ended Terms

TRACE ELEMENTS
MEDICAL RESEARCH
TOXICOLOGY

17c. COSATI Field/Group 06T 57Y

18. Availability Statement THIS TRANSLATION WAS MADE FROM A NON-COPYRIGHTED TEXT.....	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 9
	20. Security Class (This Page UNCLASSIFIED	22. Price $3.50

USCOMM-DC 40329-P71

NEUROHISTOLOGICAL METHODS IN HYGIENIC STANDARDIZATION

Prof. N. G. Fel'dman
F. F. Erisman Scientific Research Institute of Hygiene, Moscow

Of great importance in the hygienic standardization of toxic substances are special neurohistological studies which can, in a number of cases, reveal the effect of small concentrations of chemical substances in the central and peripheral nervous system. In such standardization the neurohistologist can also evaluate the degree of damage to the nervous system and help the hygienist discover the mechanism of the effect of these agents.

Microscopic study of the entire central and peripheral nervous system (in the standardization of each neurotropic substance) is beyond the power of even a complete specialized laboratory. Therefore, it has become necessary to simplify this complex process without forfeiting its scientific value. Many scientists (B. I. Lavrent'ev; A. D. Speranskiy; M. N. Tolgskaya and others) have indicated that against the background of the general reactions of the nervous system a unique, more intense response of one section of the nervous system is observed, "the master link," where pathological changes are especially pronounced.

The work of M. V. Vendilo et al., dealing with the inhalation effect of aliphatic alcohols (decyl, octyl, methyl, nonyl and hexyl), suggested to us a deeper study of the visual analysor. The study was conducted on 66 rabbits. Afferent analysors in the brain of the animals (olfactory, visual, auditory, etc.) were primarily affected. We observed perivascular edema, degeneration and death of neurons and proliferation of glia. The greatest changes were found in the path of the visual analysor (retina, optic nerve, chiasm, optic tract, superior colliculus, external geniculate bodies, visual area of the cortex).

On the basis of results of neurohistological and histochemical studies of

the action of aliphatic alcohols on the nervous system, we suggested that future study be limited to the visual analysor and that part leading to it which lacks neurons and, therefore, yields most easily to neurohistological study. We mean the optic nerve, chiasm and optic tract--collectors of ganglion cell axons in the retina of both eyes. Everyone knows the difficulty of exposing ganglion cells of the retina; impregnating slices of optic nerves, chiasm and visual tracts, according to the method of Compas, using our modification, makes it possible to obtain faultless preparations with 100% exposure of nerve fibers--normal and pathological. The degree of pathological damage to the visual analysor can be evaluated by studying these preparations. The neuron changes which we noted in optic centers confirmed our observations in nerve fibers of the optic nerve, chiasm and optic tract.

We verified this method with the experimental data of S. M. Pavlenko by the effect of methanol (peroral, inhalation and complex). Tests were made on 36 rats. We examined the internal organs, brain, optic nerve, chiasm and optic tract of the animals. The most serious pathological damage was noted along the visual analysor, particularly in the optic nerve, chiasm and optic tract.

In the standardization of mean daily maximum permissible concentrations of butyl alcohol (a substance with a sharp unpleasant odor) in atmospheric air, we concentrated our attention on reactions of the olfactory analysor (olfactory nerve, bulb and tract, hippocampus, olfactory cortex), although the usual histological and neurohistological studies served as a control. The experimental part of the work is the study conducted by B. K. Baykov.

In the test rats were used, subjected to 24-inoculation with butyl alcohol in concentrations of 20, 1 and 0.1 mg/m^3 for 92 days. Neurohistological studies showed that butyl alcohol selectively damages the olfactory analysor. Less severe changes are noted in other afferent systems and nuclei of the brain. Along the olfactory analysor pathway the most labile were the olfactory nerves, mitral neurons of the olfactory bulb and the olfactory tract. The morphological data obtained correlates completely with results of functional observations (physiological, biochemical). A butyl alcohol concentration of 20 mg/m^3 was most effective, 1 mg/m^3 was minimally effective and 0.1 mg/m^3 differed little from the control.

We suggest an accelerated method to determine the degree of reactivity of neurons in the brain to the chronic effect of toxic odorous substances in atmospheric air. It is Nessl's method of studying the olfactory bulb and Compas' method of studying the olfactory nerve, bulb and tract.

The suggested methods were verified with the effect of formaldehyde[1], a substance with a specific effect on the visual analysor and an unpleasant irritating odor. A complete histological and neurohistological study was conducted. Most reactive were the optic nerve, chiasm and olfactory tract.

Pathologists who have studied the central nervous system (P. Ye. Snesarev', L. I. Smirnov) have indicated that a number of pathological processes there are accompanied by degeneration of neurons, reflected in their dark homogeneous color, by Nissl's method. The same phenomena were noted by M. S. Tolgskaya with regard to mercury intoxication.

We observed the same changes with all these neurotropic substances. Some of the neurons of the optic and olfactory analysors were pyknomorphous, dark-colored neurons, which were clearly distinguished against a background of unaltered nerve cells. We suggest that the dark degenerated cells be counted in certain nerve centers and their number compared with that of unchanged neurons, i.e. that quantitative indices be approached in neuromorphology.

While attempting to simplify and accelerate the work, we also tried to deepen it and explain the unknown, which would provide new methods of study. We mean electron microscopy of the retina under the influence of aliphatic alcohols. Results of neurohistological studies showed that there are significant changes in the retina. But two of its elements--photoreceptors and Müller's fibers--cannot be studied with light microscopy.

We suggest using the above named neurohistological objects and adopting methods of studying them to standardize certain toxic neurotropic substances.

---

[1] Inoculation of animals conducted by V. A. Gusev.

REFERENCES

1. Vendilo M. V. In the book: Materialy II-y Nauchno-prakticheskoy konferentsii molodykh gigienistov i sanitarnykh vrachey (Material from the 11th Scientific-practical conference of young hygienists and sanitarians). Moscow, 1967, p. 119.
2. Vendilo M. V., Yegorov Yu. L., Fel'dman N. G. Gigiena truda, 1971, No. 1, p. 17.
3. Lavrent'ev B. I. Morfologiya chuvstvitel'noy innervatsii vnutrennikh organov (Morphology of sensitive innervation of internal organs). Moscow, 1947.
4. Smirnov L. I. Rukovodstvo po nevrologii. Gistopatologiya nervnoy sistemy (Neurology textbook. Histopathology of the nervous system). Moscow-Leningrad, 1941, Vol. 2, No. 1.
5. Snesarev P. Ye. Izbrannye trudy (Selected works). Moscow, 1961.
6. Speranskiy A. D. Nervnaya trofika v teorii i praktike meditsiny (Nerve trophism in the theory and practice of medicine). Moscow, 1936.
7. Tolgskaya M. S. Morfologicheskie izmeneniya v nervnoy sisteme pri professional'nykh neyrointoksikatsiyakh (Morphological changes in the nervous system during occupation intoxications). Leningrad, 1967.